

# Michigan Neurologic Scale in Early Screening for Diabetic Neuropathy in Patients with Type 2 Diabetes Mellitus

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**Abstract:** *Objective:* To apply the Michigan Neuropathy Screening Scale in social health to achieve early detection, intervention, and treatment of diabetic neuropathy in patients with type 2 diabetes mellitus. *Methods:* Fifty-eight patients with type 2 diabetes mellitus with weakened dorsalis pedis arteries attending the outpatient clinic of Huangtian Community Health Service Center, Bao'an District Central Hospital, Shenzhen City, China, from April to June 2023 were selected to undergo the early screening of diabetic neuropathy through MNSI, and those with abnormal results were pulled into the unified management of the micro-credit group for regular popularization of science. Before and after the management, the patients were surveyed on their understanding of diabetic neuropathy-related contents and their satisfaction with the doctors, and t-tests were performed on the two results. *Results:* A total of 54 valid questionnaires were obtained, of which 14 had abnormal questionnaire results, and 5 were diagnosed with diabetic neuropathy after the abnormal ones went to the hospital for electromyography. Patients' scores on the survey of understanding of diabetic neuropathy were significantly higher after management than before management ( $P < 0.05$ ), and their satisfaction with their doctors improved ( $P < 0.05$ ). The regular popularization of the WeChat group allowed patients to have a correct knowledge of diabetic neuropathy, increased attention and reduced panic, and more trust and confidence in our doctors, thus increasing the contracting rate and consultation rate of family doctors in key populations. *Conclusion:* MNSI is effective and convenient for early detection, intervention and treatment of diabetic neuropathy, and is worth promoting its application in social welfare.

**Keywords:** Michigan Nerve Scale, Type 2 Diabetes Mellitus, Diabetic Neuropathy

## 1. Introduction

Neuropathy is the most common microvascular complication of diabetes mellitus and an important cause of foot ulcers and limb amputations [1-2]. Currently there are many clinical methods used for screening diabetic neuropathy, such as temperature sensory examination, pain sensory examination, neuropathy scoring system, nerve electrophysiologic examination, and nerve biopsy [3-4]. Although nerve electrophysiology examination is considered as the gold standard for the diagnosis of diabetic neuropathy [5], the examination is relatively time-consuming and requires specialized technicians to operate, and the machine is expensive

and not suitable for social welfare. Then simple, easy to operate and high diagnostic efficacy neuropathy scoring system is an effective screening tool for diabetic neuropathy in social welfare. The Michigan Neurological Screening Scale is a reliable and concise method with high applicability and high reliability in screening diabetic neuropathy [6-7], and the results can be used as a reference for the diagnosis of diabetic neuropathy in social welfare. In this study, the Michigan Neuropathy Screening Scale was applied in social welfare to achieve early detection, early intervention and early treatment of diabetic neuropathy in patients with type 2 diabetes mellitus, to improve patients' knowledge of diabetic neuropathy and their satisfaction with doctors, and to increase the contracting rate of the key population of family doctors.

## 2. Objects and Methods of Study

### 2.1. Research Target

This study focused on 58 cases of diabetes mellitus patients seen from April to August 2023 at Huangtian Community Health Center. The clinical inclusion criteria were: meeting the WHO criteria for the diagnosis of diabetes mellitus; presence of weakened dorsalis pedis arteries; no history of cerebrovascular disease, lumbar spondylosis, toxic peripheral neuritis, chronic alcoholism, vasculitis, systemic lupus erythematosus, uremia, foot ulcers, infections, or edema; absence of psychiatric dysfunction; and positive cooperation with the study. signed an ethical informed consent form.

### 2.2. Methodologies

#### 2.2.1. Michigan Neuropathy Screening Scale

The Michigan Neuropathy Screening Scale consists of a questionnaire to be completed by the patient and a bipedal examination to be completed by the physician. The questionnaire included numbness, burning, pain, sensory hypersensitivity, tingling, water temperature perception, history of foot ulcers, history of diabetic neuropathy, whether the symptoms worsened at night, and history of lower extremity surgery, totaling 15 options with a total score of 13 points. A questionnaire  $>4$  was classified as abnormal. Bipedal examination included bipedal appearance, presence of ulcers, ankle reflexes, tuning fork vibratory sensory examination, bipedal appearance (normal = 0, deformity, infection, dryness, callus, fissure, and other abnormalities = 1 point), presence of ulcers (no = 0 points, yes = 1 point), ankle reflexes (normal = 0 points, disappeared = 1 point, the presence of heavy percussion that is, the ankle reflexes are weakened = 0.5 points), and 128Hz tuning fork vibratory sensory examination (normal = 0 points, disappeared = 1 point, weakened = 0.5 points), and the presence of diabetic nerve disease. disappearance = 1 point, weakening = 0.5 points), and both feet were examined separately, with a total score of 8

points. A bipedal examination of  $>2$  was scored as abnormal [6].

#### 2.2.2. Survey on Health Knowledge of Diabetic Neuropathy and Satisfaction with Doctors Before and After Patients' Management, Respectively

The first part of the questionnaire includes 10 questions about the dangers of diabetes, preventive and curative measures, the manifestations of diabetic neuropathy, nursing care, and what to pay attention to in daily life, with a total score of 100 points. The second part of the questionnaire is a survey on the satisfaction of the doctor, the patient's satisfaction with the doctor to score 1-10 points, 1 is not satisfied, 10 is very satisfied.

#### 2.2.3. Statistical Analysis

A t-test was performed using the R-test for the survey scores of patients' knowledge of diabetes-related content before and after management.

## 3. Results

### 3.1. Early Screening for Diabetic Neuropathy

Of the 58 study subjects, 54 valid questionnaires were obtained, except for 4 cases of non-cooperators, of which a total of 14 had abnormal results, and 5 cases were diagnosed with diabetic neuropathy after the abnormal ones went to the hospital for electromyography.

### 3.2. Patients' Perception of Diabetic Neuropathy and Physician Satisfaction

The diabetic neuropathy health knowledge survey was administered to 14 patients with abnormal screening on the Michigan Neuropathy Scale, and the post-management scores were significantly higher than the pre-management scores, with a statistically significant difference ( $P<0.05$ ). Physician satisfaction scores were also significantly higher ( $P<0.05$ ).

**Table 1.** Comparison of health literacy scores and physician satisfaction scores before and after patient management ( $\bar{x} \pm s$ ,  $n=14$ ).

	pre-management	post-administration	P-value
Health Literacy Score	64.23 $\pm$ 12.53	92.69 $\pm$ 5.04	$<0.01$
Physician Satisfaction Score	6.08 $\pm$ 1.86	9.46 $\pm$ 0.63	$<0.01$

### 3.3. Increase in Contracting and Consultation Rates for Key Populations

Diabetic patients belong to the key population in the family doctor contracting population. All diabetic patients participating in the study agreed to sign up for a family doctor and to follow up with regular visits to the community health center for blood glucose monitoring.

## 4. Discussion

Diabetes mellitus has a long duration of illness and many complications, among which diabetic neuropathy is a common

complication, and most of the patients have a low awareness of diabetic neuropathy and do not pay enough attention to its development, which is also the main factor that causes foot amputation, gangrene, and ulcers in patients [8]. Some studies have shown that long-term effective health education is important for the prevention of complications related to diabetic neuropathy [9]. Diabetic neuropathy can be examined according to electromyography (EMG), which is a sensitive and accurate way to diagnose diabetic neuropathy because EMG is not easily interfered by other factors [10], but the process of electromyography takes a long time and has a high cost, and the patients usually do not choose this way, so it is difficult to be widely used in the community. In fact, the

follow-up and treatment of diabetes mellitus usually sink to the community health, through the family doctor can effectively improve the patients' understanding of the disease, improve the patients' cooperation and control rate, so as to ensure the normal life of the patients and improve the quality of life [11-12].

The Michigan Nerve Screening Scale (MNSS) was first applied in 1994 [6], and it consists of two components: the first part is the patient self-assessment, which consists of 15 items, mainly evaluating the subjective feelings of the patient on the clinical symptoms and signs; the second part is the physical examination, which consists of 4 items, mainly evaluating the appearance of the feet, the ulcers, the ankle reflexes, the vibration sensation, etc. The higher the score, the more severe the diabetic peripheral neuropathy is [13]. The higher the score, the more severe the diabetic peripheral neuropathy [13]. In this study, the Michigan Nerve Screening Scale was used to screen for diabetic neuropathy at the community health center, and some patients were successfully screened. At the same time, the health management of those with abnormal scores on the Michigan Neurological Screening Scale and regular health education can effectively improve the patients' awareness and attention to diabetic neuropathy, which can slow down the development of the disease to a certain extent.

Diabetic neuropathy is generally a slowly developing process, and the patient's condition and symptoms are often not synchronized. If diabetic neuropathy can be detected as early as possible, and the patient's blood glucose can be reasonably controlled, and the patient's foot care can be done well, it can prevent the emergence of amputation, gangrene, foot ulcers and other phenomena to a certain extent [14-15].

## 5. Conclusion

Early screening for diabetic neuropathy is very important. Michigan neuropathy screening is a relatively simple operation, convenient to complete in the community, can be based on the actual situation of the patient examination, slow down the progress of the patient's disease at the same time can improve the patient's awareness and satisfaction with the doctor, increase the contract rate of the key populations of the family doctor and the rate of consultation, it is worthwhile to promote the use of the screening process of diabetic patients in the community.

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